

# Utilizing GIOVANNI in Earth System Science Education Alliance Learning Modules

Dr. Paul Adams

Anschutz Professor of Education and Professor of Physics

Fort Hays State University

[padams@fhsu.edu](mailto:padams@fhsu.edu)

19:30 EDT

Analyses and visualizations used in this [study/paper/presentation] were produced with the Giovanni online data system, developed and maintained by the NASA GES DISC.

# ESSEA

- Earth System Science Education Alliance
  - NASA, NSF, and NOAA-supported program
  - Mission: To improve the quality of geoscience instruction for pre-service and in-service K-12 teachers.

# ESSEA Modules



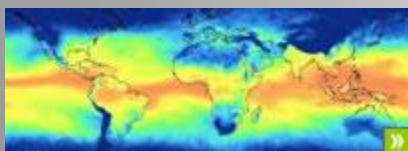
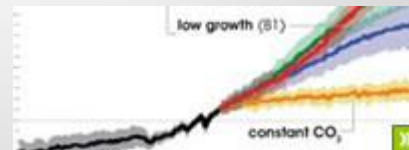
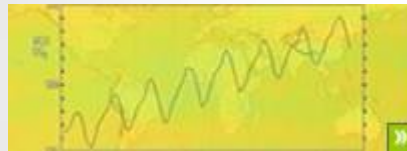
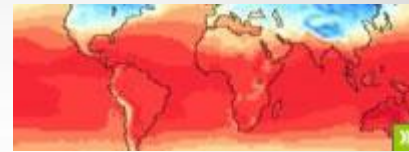
- Event-centered, data-analysis-lead instruction
  - Problem Based Learning for K-12
  - ESS data analysis
    - Accessed using GIOVANNI
    - Demonstrates interdisciplinary nature of mathematics and science
    - Demonstrates intersection of nature; i.e., a problem in one area is indicative of problems in many others

# Sample Module

- Scenario
  - Event, problems, context, and extenuating circumstances provided
- Tasks
  - Basic: requires simpler, less in-depth data analysis and synthesis.
  - Comprehensive: extensive analysis and synthesis, projects often cover years of data. Good for older students.

# ESSEA NASA Climate Modules

<http://esseacourses.strategies.org/>



# Carbon City

- Scenario:

Carbon dioxide has been increasing in the atmosphere, and the increase is attributed to human activity.[...]However we count and however we look, changing the carbon use of cities has the potential to dramatically alter the amount of carbon dioxide released into the atmosphere. But where should we start?

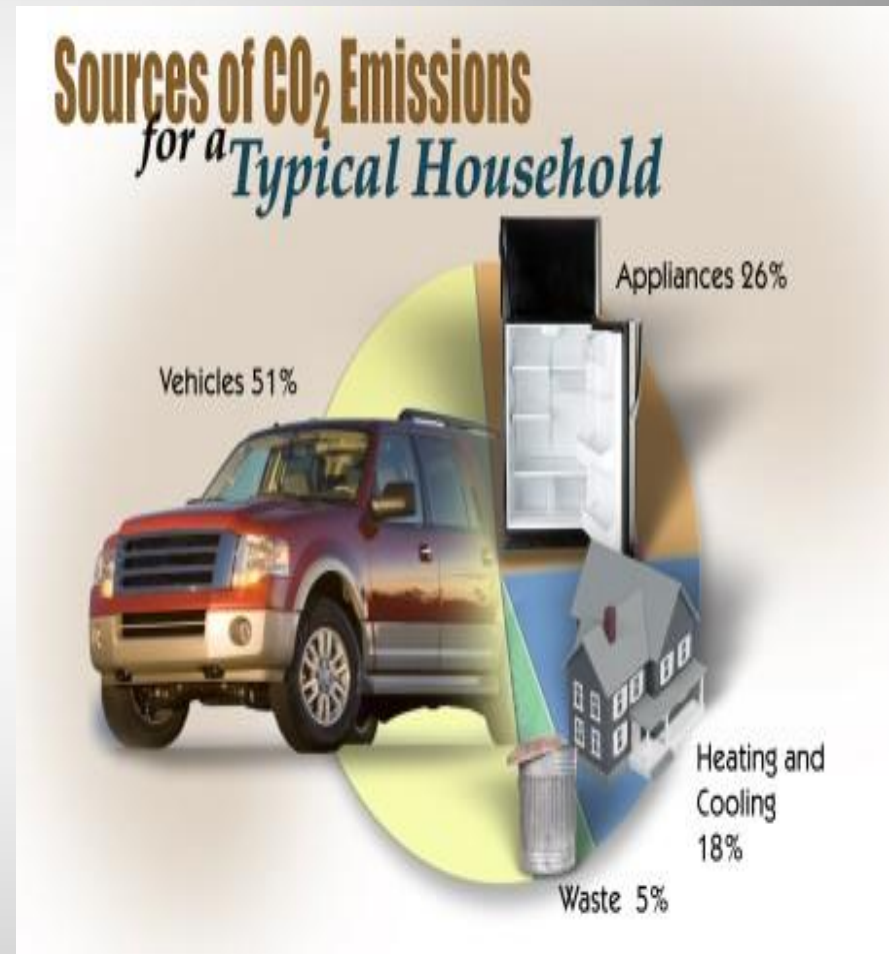


Image Credit: Fueleconomy.gov

<http://www.fueleconomy.gov/feg/images/carbonFootprint/HouseholdCO2Pie.jpg>

# Carbon City

- Basic Task:

Your team has been asked by NASA to carry out an atmospheric science investigation for developing a community-based strategy to reduce the human production of greenhouse gases for a major urban area near your location by improving air quality. [...] The investigation will require baseline information about the rate of increase of atmospheric carbon dioxide, nitrogen oxides, and carbon monoxide downwind from your location during each season from a recent year using MY NASA DATA, GIOVANNI, or NASA's Eyes on the Earth sites.

# Carbon City

- Comprehensive Task:

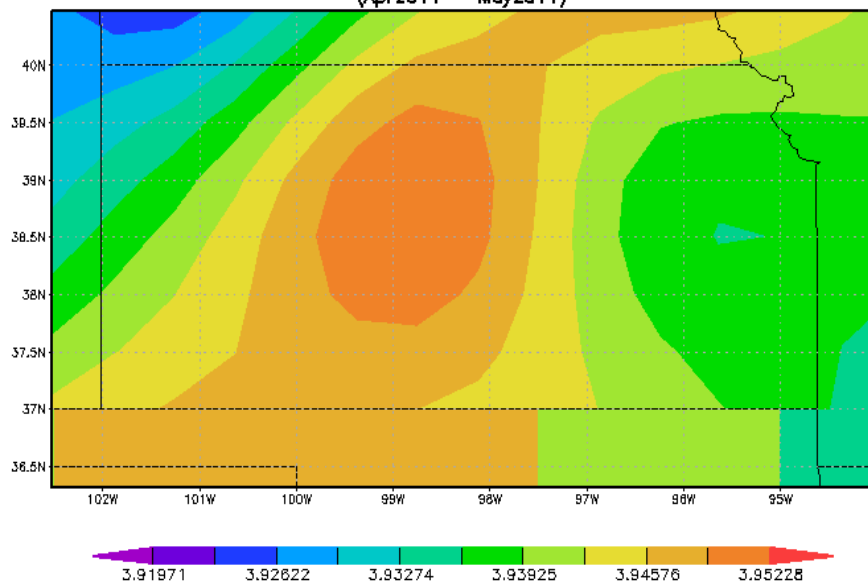
Identify two urban areas that are located in two different geographic regions. Develop community-based mitigation strategies in the transportation sector that are culturally and regionally appropriate, specify a reduction goal, funding needs, and how to achieve inclusive participation. As a key part of the analysis include a baseline seasonal images of air quality gases and carbon dioxide. Estimate how these will change over a period of three years after full implementation of your plan. The final document should also include an ESS analysis prior to the implementation of the plan and following implementation of the plan.



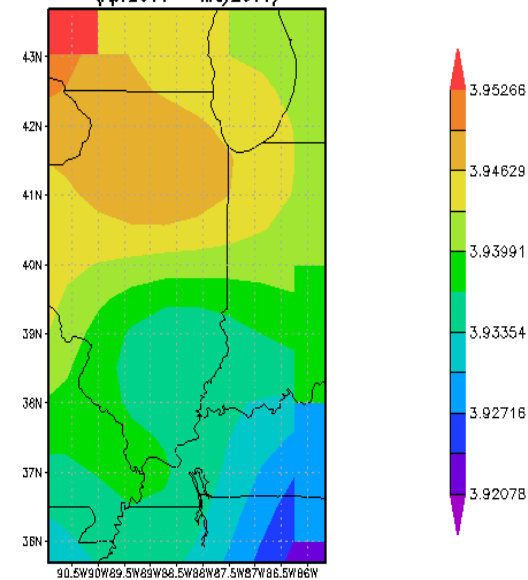
# A quick primer in the ESSEA Modules

- [http://esseacourses.strategies.org/GlobalClimateChangeScenerio\\_Visualizations.pdf](http://esseacourses.strategies.org/GlobalClimateChangeScenerio_Visualizations.pdf)

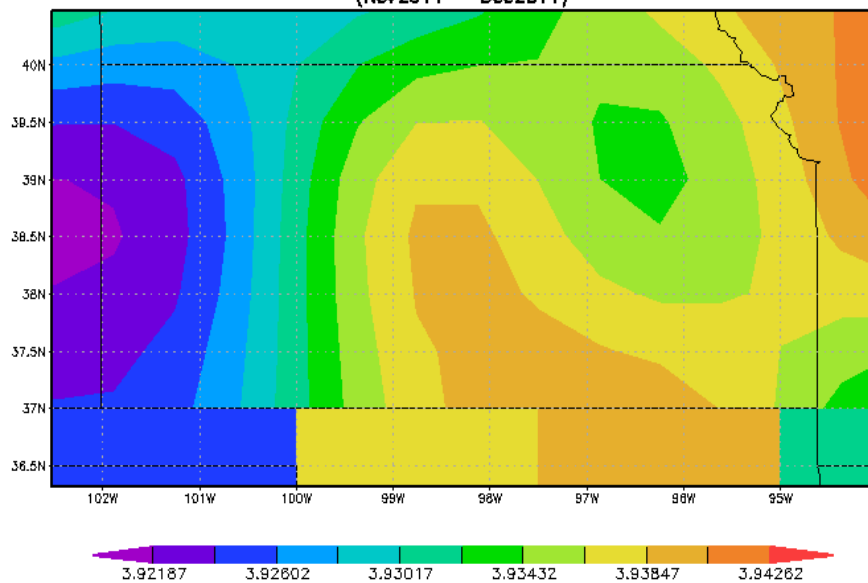
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(Apr2011 - May2011)



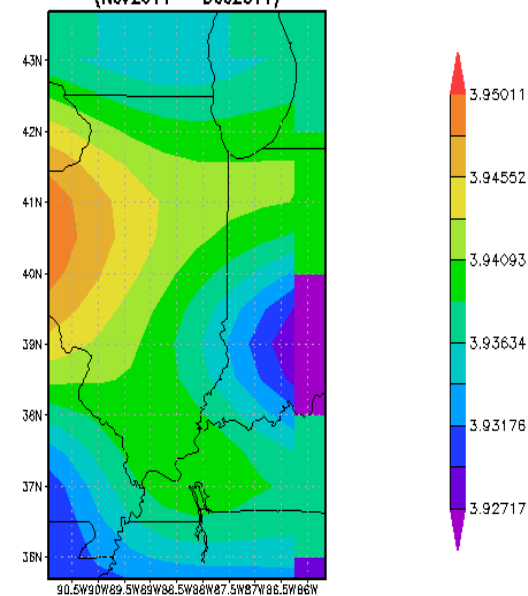
AIRX3C2M.005 CO2 fraction  $[(10^{-4})\text{mole fraction}]$   
(Apr2011 - May2011)



AIRX3C2M.005 CO2 fraction  $[(10^{-4})\text{mole fraction}]$   
(Nov2011 - Dec2011)

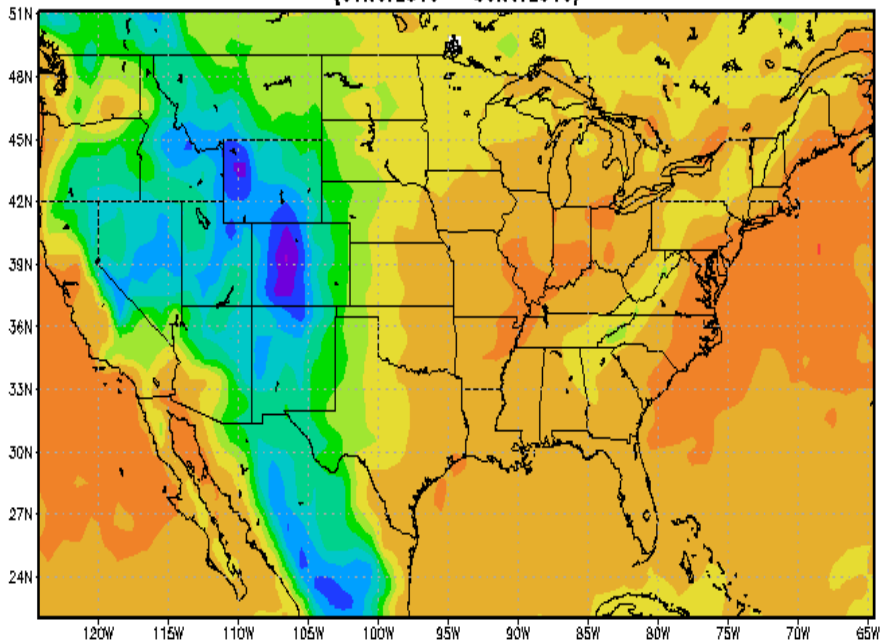


AIRX3C2M.005 CO2 fraction  $[(10^{-4})\text{mole fraction}]$   
(Nov2011 - Dec2011)

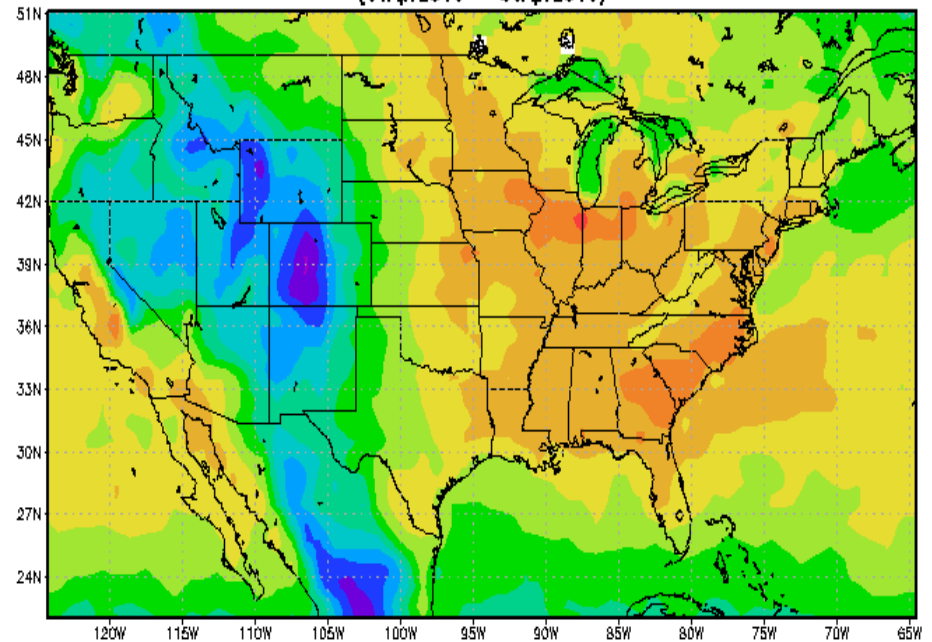


# CO Ascending

AIRX3STD.005 total column CO ascending (CO total column\_A) [10E18 molecules/cm2]  
(01Nov2010 - 30Nov2010)



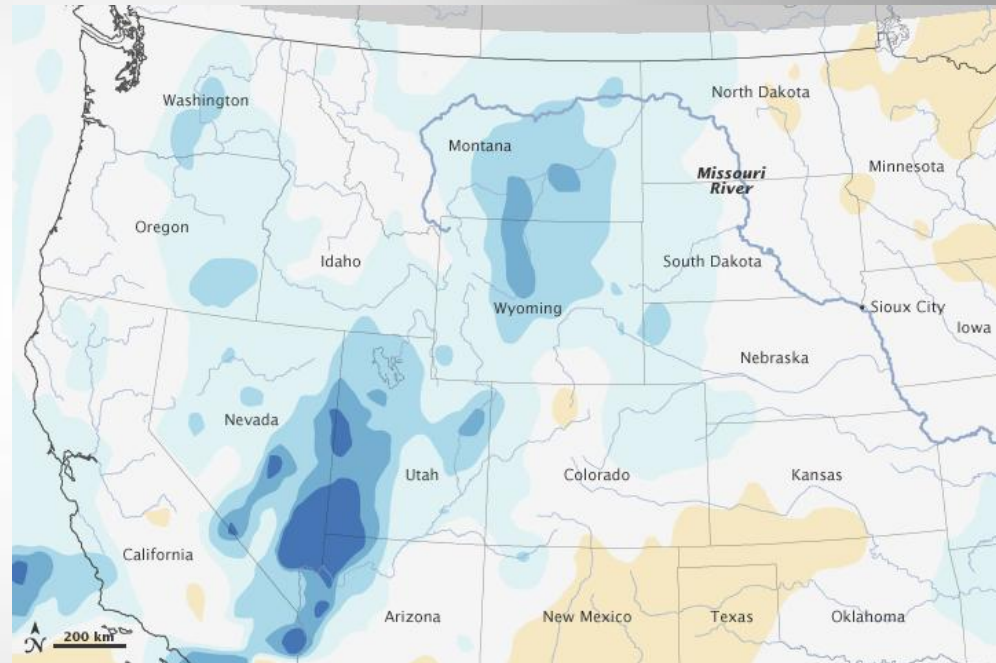
AIRX3STD.005 total column CO ascending (CO total column\_A) [10E18 molecules/cm2]  
(01Apr2010 - 30Apr2010)



# When Extremes Become the Means

- Scenario:

Scientists suggest that while the types of extreme weather events that we are seeing have been rare in the past, a slight shift in average global temperature is likely to increase the number of extreme events from an event that happens once in a century to one that occurs several times a century. [...] If weather extremes become the new weather means, what weather events must a community plan for in the next 10 to 100 years?



Rainfall anomalies in the Missouri River Basin for May 2011, compared to the 1998-2010 average. Below-average percentages are brown, and above-average percentages are blue.

Image Credit: NASA

<http://eoimages.gsfc.nasa.gov/images/imagerecords/51000/51429/uswest>

# When Extremes Become the Means

- Basic Task:

The IPCC is interested in whether climate change has an impact on weather, especially as it relates to extreme events such as major precipitation events, intense storms, heat waves, drought, and hurricanes. Now that you are working as interns to their committee on climate change, they have asked you to conduct an analysis of weather and climate events using NASA's NEO tool.

# When Extremes Become the Means

- Comprehensive Task:

NASA GISS has been contacted by the National Governors Association to provide an analysis for your state or region about extreme weather events with the greatest probability of increasing. Coupled with this report is a detailed ESS analysis of how these events will impact the state or region to aid the governors in developing mitigation policies. NASA is expecting a trend analysis of environmental measures, such as those accessible through GIOVANNI, MY NASA DATA, or NASA's Global Climate Change: Vital Signs of the Planet, as the basis for your analysis.

Monthly TRMM 3B43(V6) (Jun1998-Jun2011)  
Rainfall Anomaly [mm]  
Baseline: TRMM 3B43 V6 Rainfal Climatology

